# A Case Study of Networked Portfolio Assessment System for Cooperative Learning


## Abstract

This study examines the usefulness of a networked portfolio assessment system for cooperative learning. The system is with instructional methods that expresses ideas via written report and oral presentation, accumulated dialogues through inquiries between peers, critical thinking via peer-assessment and self-assessment, and knowledge construction via practical assignment. In this pilot study, both grades of peer-assessment and instructor-assessment were used to evaluate the students' performance. Students answered a post questionnaire that measured their attitudes toward the system. Forty-six juniors, majoring in information management, enrolled in a course called "Internet Technology" and were assigned to twenty-three teams. Each team was assigned to implement a web-based system (e.g. an on-line travel system or an on-line bookstore) capable of performing certain functions. The quantitative results revealed that the students' achievements increased significantly from first round to second round and that more students were willing to join the learning activities similar to this study.



**Keywords:** Portfolio assessment, Cooperative learning, Internet Technology, Information management


## Background

Management of portfolios is a means of accumulating the assignments of students. Such assignments reveal the learning processes of a particular student (Liu, Lin & Yuan, 2001). Assessment of portfolios through peers and self-reflection enhances a student's critical thinking and motivation to learn. It is a good alternative assessment method to evaluate college students (Reeves, 2000). In the past, the portfolio-assessment focused on the outcome of individual. The combination of portfolio-assessment and cooperative learning under a networked system has seldom been explored. For example, Chang (2001) designed a web-based learning portfolio system that enables a student to

submit his (or her) assignment, collect his (or her) assignment, evaluate other students' assignments, and browse other students' assignments. Chang (2001) did not consider the functions for cooperative learning (e.g., team-forming, discussion forum for team members).

Researches in cooperative learning claim that students learn better when they learn together (Johnson & Johnson, 1989; Qin, Johnson & Johnson, 1995). Cooper and Mueck (1990) have defined cooperative learning as a structured and systematic instructional strategy wherein teams work together toward a common goal. The learning activities of cooperative learning should include negotiating a common goal with team members, being responsible for team members' learning as well as one's own, assigning complementary roles and tasks to individuals within each group and cultivating social skills for effective cooperative learning (Koschmann, Hall & Miyake, 2002; Slavin, 1995; Springer, Stanne & Donovan, 1999). Springer, Stanne, and Donovan (1999) claim that learning activities of cooperative learning need a more authentic assessment of higher-order thinking and problem solving. Therefore, the combination of portfolio-assessment and cooperative learning should be done to enhance each other and to form a brand new cooperative-competitive learning strategy. In such a learning environment, a student should cooperate with his (or her) team members. Each team should do their best to compete with other teams. The author regards cooperative learning as the most important part of the cooperative-competitive learning strategy. Furthermore, the cooperative-competitive learning strategy could easily be applied in classroom activities and online learning activities.

Portfolio-assessment for cooperative learning can be implemented as a networked system. In this study, the learning system is composed of three distinct functions: the first sub-system, the second sub-system and the third sub-system.

The first sub-system focuses on the management of portfolios (e.g., students can collect, make selections from and reflect on themselves and the team). This function was extended from the networked portfolio system (Liu, Lin & Yuan, 2001).

The second sub-system focuses on peer-assessment and self-assessment (extended from

networked peer assessment system, Liu, Chiu, Lin & Yuan, 2001). The third sub-system focuses on facilitating cooperative learning (e.g., the function of team-forming for instructor to use and the discussion forum for team members).

## Pertinent literature

Paulson, Paulson, and Mayer (1991) said that a portfolio is a purposeful collection of a student's work that tells the story of the student's progress. It is also a collection of items that reveals different aspects of an individual's growth and development over time. Shores and Cathy (1998) have divided the portfolio into three types: 1) Private portfolio 2) Learning Portfolio and 3) Pass-along Portfolio.

Private Portfolio is one you probably already keep (e.g., photographs of some academic activities). Learning Portfolio will encourage richer reflection and communication within your program. It is the most fun and the most rewarding to implement. Pass-along Portfolio is a condensed vision of the first two.

Russell and Butcher (1999) discovered a number of advantages after analyzing the use of portfolios in educational technology courses. One of them is that portfolios allow each student to determine what they want to learn and how they demonstrate their knowledge and skills. Portfolios also include a lot of information and artifacts and provide a method for students and instructors to do outcome assessment. It also allows students to reflect on their assignments and abilities.

Russell and Butcher (1999) also indicated the limitations of portfolios. One of them is that portfolios require more time compared to other evaluation approaches. The benefits of portfolios are also not appreciated and understood by some students. There is also lack of research evidence in the value of portfolios.

## System

This study presents a web-based system, Networked Portfolio ASsessment System for Cooperative Learning (hereinafter referred to as NetPASS for CL), which coordinates student learning in a manner similar to that of researchers, scientists and practitioners. The author utilized the Windows

2000 server to be the operating system, the Internet information system 5.0 to be the web server and the SQL server 7.0 to be the database management system. The author has implemented the functions of NetPASS for CL (referred to figure 1) by using server-side programs to retrieve and store database information. These server-side programs were coded with ASP (active server pages).

Students can turn in their assignment directly through this online system. Because the assignment is in the same format as a HTML (hypertext markup language) file, the assignment can be stored directly into the file system, which can be read by reviewers through the web browser.

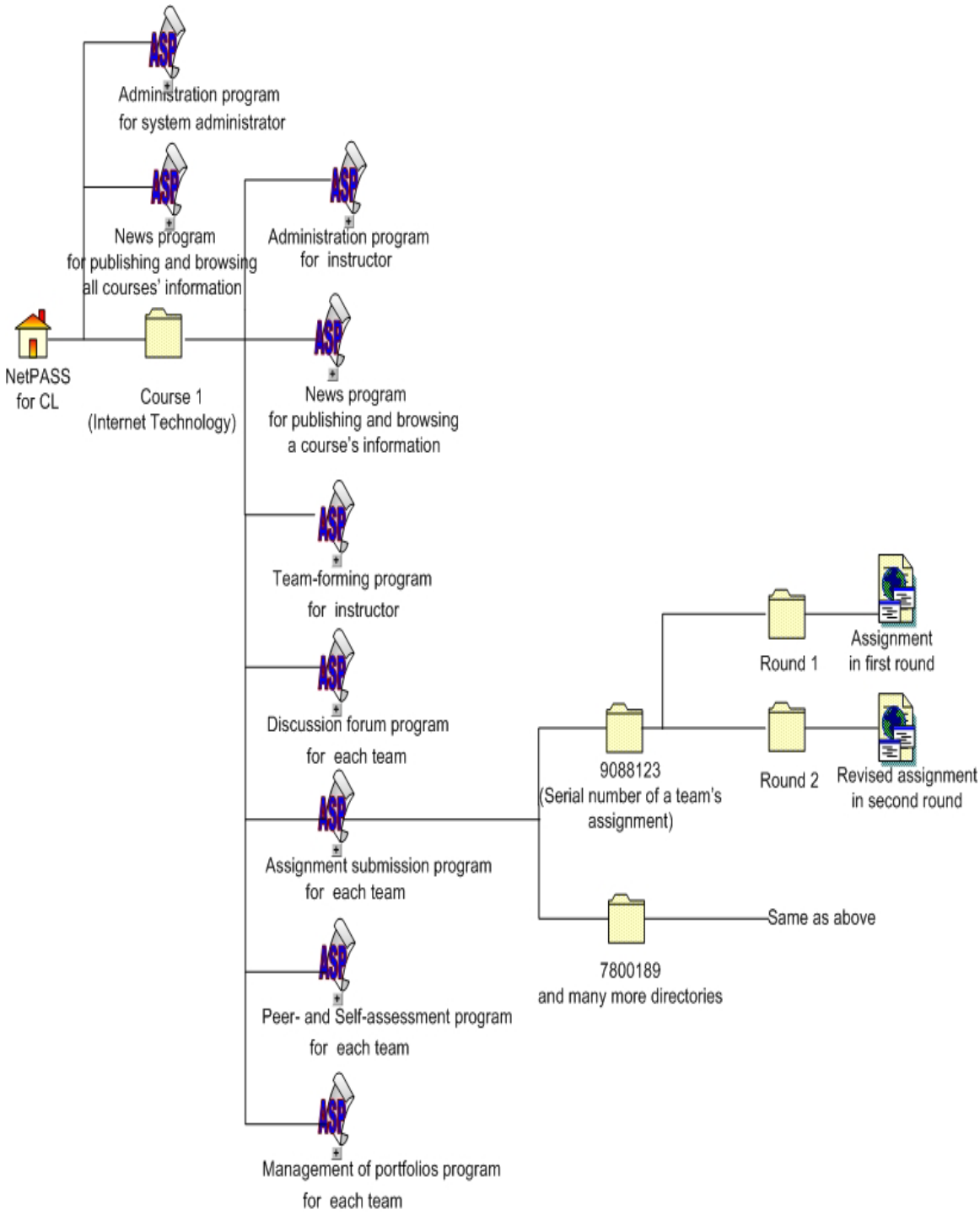


**Figure 1.** System architecture of NetPASS for CL (adapted from Liu *et al.*, 2001)

The System administrator of all classes can create a new class through the administration program. Once the class is created, the system establishes a new directory using the ID (e.g., course1) assigned to this class. The pre-defined programs are generated as well. Meanwhile, the new directory comes with some programs (referred to figure 1). Thus, each class is independent in that it has its own directory. The instructor of this course can manage

the students' learning activities through the administration program, the news program and the team-forming program. Class management includes the student's enrollment information, assessments and team assignments. The enrolled students can turn in their team assignment, modify their team assignment, receive and give grades, receive and give suggestions as well as view the assignment of other students. When a student has turned in his (or her) assignment, this assignment will be given a random number by the system together with an established directory. This assignment is therefore stored in the directory. In doing so, each assignment can be recorded distinctly before and after each round of modification.

## Procedures

The students were instructed to do the following procedures:

- Learn the educational objectives of cooperative learning, portfolio-assessment, peer-assessment and self-assessment at the start and study real samples from previous semesters to prepare students for later activities. (This step is done in the first semester and lasts about 3 hours)
- Familiarize one's self with teaching materials covered in this semester. (Each topic was scheduled for 1~2 weeks)
- Be assigned to a team with one student through the simulated annealing K team-forming algorithm for heterogeneous grouping (Liu, 2002). The self-efficacy scale (Lin and Liu, 2001) is the input of the above algorithm.
- Discuss the assignment and the criteria with the instructor to make corrections via NetPASS for CL and face-to-face (This step lasts about a week).

  1. The instructor discusses the criteria to mark an assignment with students in classroom teaching.

  2. Students can discuss the assignment with the instructor informally via NetPASS for CL after classroom teaching.

  3. The criteria for the assignment are creativity, feasibility and correctness. The ratings are divided into ten categories: from "extremely excellent (10)" to "extremely poor (1)".

- The assignment completed by the teams is uploaded into the system (This step lasts about a

week).

1. Teams complete the assignment by themselves.

2. Teams were instructed to complete the work and submit it to NetPASS for CL within a week. Otherwise they receive no credit on this assignment.

- The system randomly assigns reviewers (each reviewer grades three to four assignments).

1. The procedure is automatically done by the system after all teams have uploaded their own assignments to NetPASS for CL.

2. In this study, three assignments were assigned to each reviewer according to past experiences (Liu *et al.*, 2001).

- Reviewers grade and comment their own as well as their peers' assignments (This period lasts about a week).

1. Students assess each assignment per day to alleviate loading.

2. Students only need to write down their reflections about themselves' assignment when they assess their own assignment.

3. Students must give grades and comments to peers' assignments when they do peer-assessment.

- The system notifies the students of their grades and comments.

1. NetPASS for CL automatically instructs each student to browse the results of their peer-assessment and self-assessment via e-mail (after the review process).

- Based on the comments coming from other teams, students must make corrections or modifications. (This period lasts about a week).

- The above steps are repeated once or more than once (researchers can select times of repetition based on their needs).

1. In this study, teams were requested to submit their assignments again.

2. Each team must present their assignment orally in front of other teams and in front of the instructor after the assessment procedure.

## Data Analysis

Owing to the limited number of students and groups (which was restricted to twenty-three groups and forty-six students from a university of science and technology at northern Taiwan), experimental research methods could not be used to empirically confirm the partial effects of cooperative learning, portfolio-assessment, peer-assessment and self-assessment. In this study, the author measured the instant progress between the first round and the second round using peer assessment and instructor assessment. Past studies (Lin, Liu & Yuan, 2001; Tsai, Lin & Yuan, 2002) show that there is only a significant difference in a student's progress between the first round and the third round.

The author was interested in the students' attitudes toward NetPASS for CL from a variety of perspectives. One of the students' attitudes is their willingness to join learning activities via NetPASS for CL in the near future. The author was also interested to discover more qualitative feedback from students via open-ended questions (after participating in learning activities in this study).

## Research Questions

Research Question 1: Is peer-assessment an effective evaluation method? Does a significant positive correlation (external validity) exist between the instructor and the students over the last two rounds of evaluation?

Research Question 2: Does each team progress instantly? Does a significant difference exist between the first round and the second round?

Research Question 3: Were most students satisfied with each component of NetPASS for CL?

## Results

**Analysis of teams' performance**

Table 1 shows that there are significant, positive correlations between the instructor and the students in terms of creativity, feasibility and the correctness (after two rounds of evaluation).

**Table 1:** Pearson's correlation between instructor and students

| Criteria | Pearson's Correlation |
|---|---|
| Creativity | .79** |
| Feasibility | .78** |
| Correctness | .89** |
| *: $p < 0.05$, **: $p < 0.01$ | |

Table 2 shows that there are significant improvements in the area of creativity, feasibility and correctness after two rounds of evaluation. This result agrees with a previous study (Lin, Liu & Yuan, 2001; Johnson & Johnson, 1989; Qin, Johnson & Johnson, 1995).

**Table 2:** Descriptive analysis and t test of round 1 and round 2

| Criteria | Mean (From peers) | Improvement | Mean (From instructor) | Improvement |
|---|---|---|---|---|
| Creativity (round 1) | 6.68 | | 6.57 | |
| Creativity (round 2) | 7.08 | Paired t = 2.96** | 7.39 | Paired t = 10.22*** |
| Feasibility (round 1) | 7.28 | | 7.16 | |
| Feasibility (round 2) | 7.79 | Paired t = 3.43** | 7.54 | Paired t = 4.44** |
| Correctness (round 1) | 7.06 | | 7.00 | |
| Correctness (round 2) | 7.69 | Paired t = 4.32** | 7.57 | Paired t = 3.21** |
| **: $p < 0.01$, ***: $p < 0.001$ | | | | |

**Analysis of students' attitudes toward NetPASS for CL**

- *Willingness to join learning activities via NetPASS for CL in the near future*: Question 1 shows that 65% (chi-square =4.26*) of the students are willing to join learning activities via NetPASS for CL in the near future. Feedback from structured interviews indicates that majority of students regard learning activities as effective and benefit tremendously from NetPASS for CL.

- *Satisfied with NetPASS for CL in sum*: Question 2 shows that 72% (chi-square =8.70**) of students are satisfied with NetPASS for CL in sum.

- *Convenient in submitting an assignment*: Question 3 shows that 76% (chi-square =12.52***) of students agree that submitting an assignment via NetPASS for CL is easy.

- *Satisfied with the user interface of presenting an assignment on the browser*: Question 4 also

shows that 93% (chi-square =34.78***) of students are satisfied with user interface of presenting a report on the browser.

- *Convenience in assessing an assignment*: Question 5 shows that 74% (chi-square =10.52***) of students agree that assessing peers' assignment via NetPASS for CL is easy.
- *Satisfied with the user interface of presenting reviewers' evaluation on the browser*: Question 6 shows that 85% (chi-square =22.26***) of students are satisfied with the user interface of presenting reviewers' evaluation on the browser.
- *Convenience in managing one's portfolio*: Question 7 shows that 83% (chi-square =19.57***) of students agree that managing each team's portfolio via NetPASS for CL is easy.
- *Perceived usefulness of the management of portfolios program*: Question 8 shows that 78% (chi-square =14.70***) of students agree that management of portfolios program is useful.
- *Convenience of the discussion forum program*: Question 9 shows that 87% (chi-square =25.13***) of students agree that discussing with their team members via NetPASS for CL is easy.
- *Perceived usefulness of the discussion forum program*: Question 10 shows that 83% (chi-square =19.57***) of the students agree that the discussion forum program is useful.
- *Satisfied with the user interface in presenting course information on the browser*: Question 11 shows that 85% (chi-square =22.26***) of students are satisfied with the user interface in presenting reviewers' evaluation on the browser.
- *Satisfied with the team members dispatched via team-forming program*: Question 12 shows that 80% (chi-square =17.04***) of the students are satisfied with the team members dispatched via the team-forming program.

## Discussion and Conclusion

This study examined the usefulness of NetPASS for CL. Students' learning is achieved through two consecutive assessments and related improvements. In doing so, students hopefully make progress in the second round. The author has assigned the same reviewers to grade the same assignment in every round. Doing so allows the same reviewers to examine whether or not the assignment has been modified according to previous comments. The result shows that students improved each round. However, this study did not include a control group, thereby leaving some related issues unresolved. For example, the team-forming through automatic procedure is better than through each student's own choice. As a whole, the use of the web-based system facilitates collaborative learning and the progress of the lead teams' assignments.

This study also examined the usability of NetPASS for CL. Sixty five percent of students are willing to join learning activities via NetPASS for CL in the near future. The shortages of learning activities under NetPASS for CL, as pointed out by another 35% of students, were as follows: 1) More peer pressure compared to other courses (38%) 2) Learning procedures are time consuming (31%) 3) Some teams tend to give extremely low scores to some assignments (19%) 4) Suggestions from other teams are useless for some assignments (6%) 5) Team members have their own ideas and are hard to negotiate with (6%).

Some of these shortages, according to students, may be advantages for instructors. Students have revised their own assignments due to greater peer pressure compared to other courses. Of course, the learning activities and the team-forming algorithm should be revised in order to increase the satisfactory performance of students.

Second, seventy two percent of students are satisfied with NetPASS for CL. The shortages of the system, according to some students, were as follows: 1) Slow downloading time (100%). The speed of downloading is related to the outdated network devices. One way to address this problem is to upgrade the outdated network devices or indicate the response times of the downloading feature next to the hyperlink (Nielsen, 1999).

Third, most students believe that the user interface of presenting an assignment on the browser is easy to use in submitting an assignment, in assessing peers' assignment, in presenting the reviewers' evaluation on the browser, and so forth.

Finally, this preliminary study also proved the usability of major functions of NetPASS for CL. In the next study, the author should include more qualitative analyses on the interactions within a team (Koschmann, Hall & Miyake, 2002) and adopt the experimental design to prove more detailed research questions.

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